

# **NCDOT Traffic Noise Abatement Policy**

Gregory A. Smith, LG, PE  
Human Environment Unit  
Project Development & Environmental Analysis

NCDOT Board of Transportation  
Environment-Planning and Policy Committee  
November 4, 2009

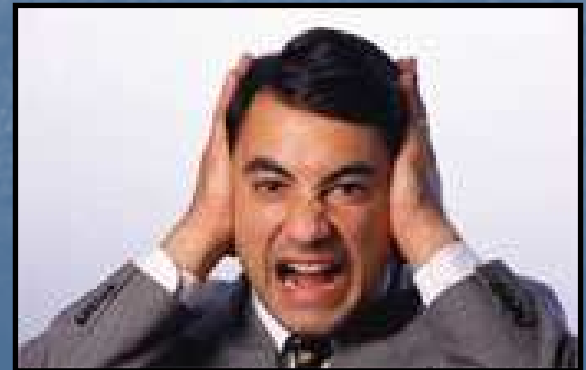
# Agenda

- ◆ **Traffic Noise 101**
- ◆ **Federal Regulations**
- ◆ **Current Policy**
- ◆ **Policy Review**
- ◆ **Upgrade Considerations**
- ◆ **Input Solicitation**
- ◆ **Associated Activities**

# Traffic Noise 101

# Noise

- ♦ **Generally defined as unwanted sound**
- ♦ **Perception of noise varies among individuals**
- ♦ **Perception is influenced by:**
  - Previous exposure to source
  - Frequency (pitch)
  - Duration
  - Impulsiveness
  - Attitude
  - Visibility of Source





# Traffic Noise = Quality of Life Issue

## Impacts Livability

- ♦ Sleep Disturbance
- ♦ Annoyance
- ♦ Health Impacts (Stress)
- ♦ Impacts Task Performance
- ♦ Speech Interference



## Common Outdoor and Indoor Noises

Outdoor Noises	Sound Pressures (uPa)	Sound Pressure Levels (dB)	Indoor Noises
Jet Flyover at 300 m	6,324,555	110	Rock Band at 5 m
Gas Lawn Mower at 1 m	2,000,000	100	Inside Subway Train (New York)
Diesel Truck at 15	632,456	90	Food Blender at 1 m
Noisy Urban Daytime	200,000	80	Garbage Disposal at 1 m Shouting at 1 m
Gas Lawn Mower at 30 m	63,246	70	Vacuum Cleaner at 3 m Normal Speech at 1 m
Commercial Area	20,000	60	Large Business Office
Quiet Urban Daytime	6,325	50	Dishwasher Next Room
Quiet Urban Nighttime	2,000	40	Small Theatre, Large Conference Room (Background)
Quiet Suburban Nighttime	632	30	Library
Quiet Rural Nighttime	200	20	Bedroom at Night Concert Hall (Background)
	63	10	Broadcast and Recording Studio
	20	0	Threshold of Hearing

Deafening

---

Very Loud

---

Loud

---

Moderate

---

Faint

---

Very Faint

# Key Definitions

**Leq** = equivalent sound level = constant, average sound level that contains same amount of sound energy over the time period as does the varying levels of actual traffic noise

**decibel** = unit measure of sound; A-weighted to capture human hearing range

**noise receptor** = any structure that receives any level of noise (not necessarily excessive)

**benefited receptor** = any receptor that receives a 5 decibels or more reduction in noise due to a noise abatement measure

# Level of Highway Noise Depends on Three Things:

- ◆ Volume of Traffic
- ◆ Speed of Traffic
- ◆ Volume of Trucks

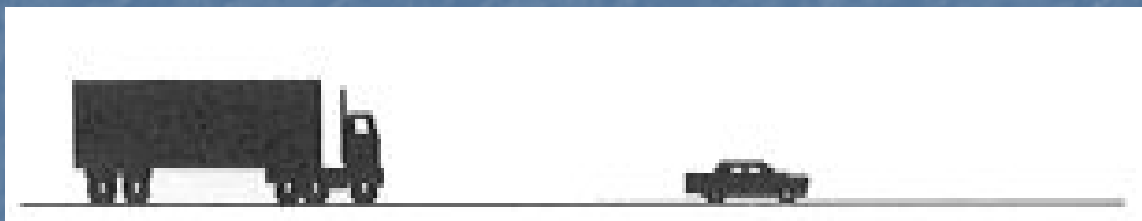




# How Traffic Volume Affects Noise



2000 vehicles per hour sound twice as loud as



200 vehicles per hour

# How Traffic Volume Affects Noise

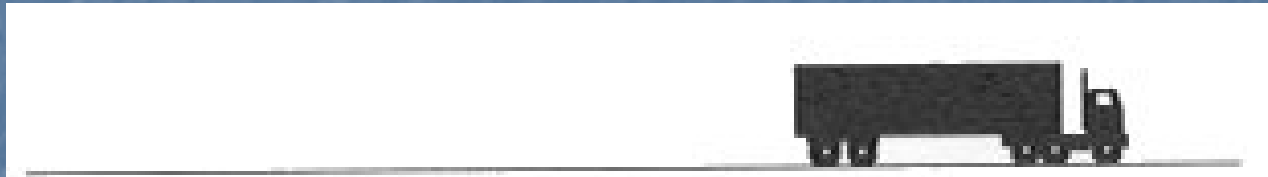


Traffic at 65 miles per hour sounds twice as loud

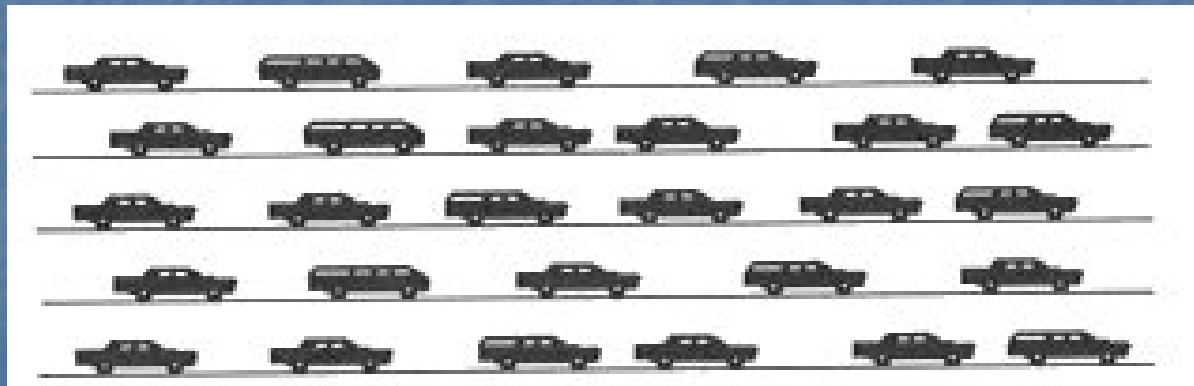


Traffic at 30 miles per hour

# How Trucks Affect Traffic Noise



One truck at 55 miles per hour sounds as loud as



28 cars at 55 miles per hour

# Sources of Highway Noise:

- ◆ Vehicle Drive Train & Exhaust Noise including “Jake Brakes”
- ◆ Tire / Pavement Interaction
- ◆ Aerodynamics of Vehicle



# Sound Perception

Change in Sound Level	Perception
3 dBA	Barely Perceptible
5 dBA	Clearly Perceptible
10 dBA	Twice As Loud

# Sound Level Decreases 3 dBA With Each Doubling of Distance

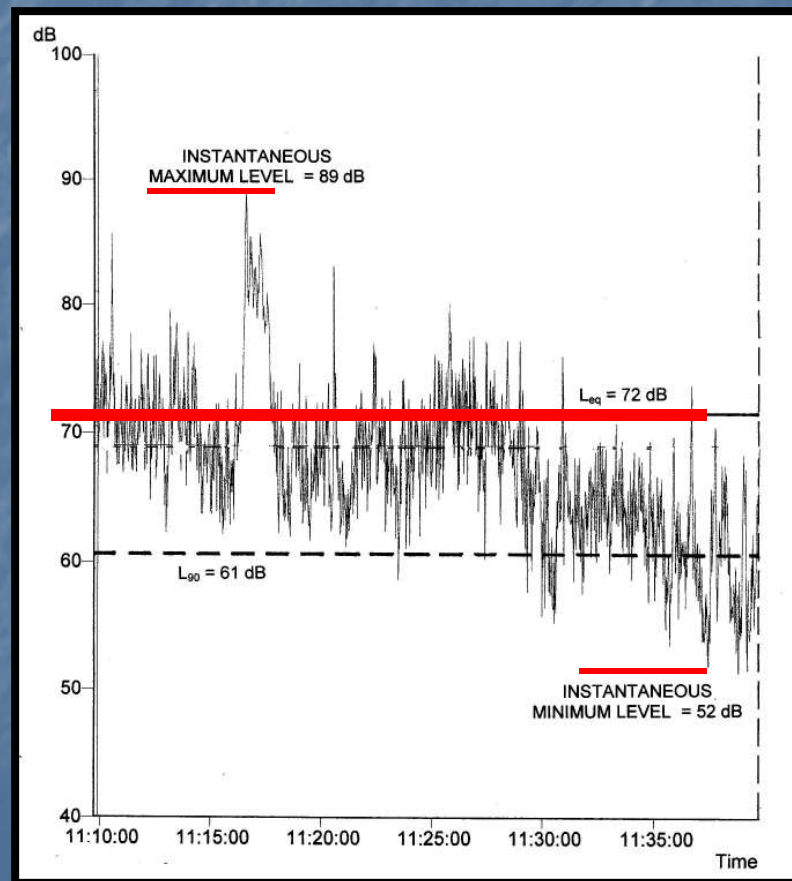


# Traffic Noise Analysis

## Traffic Noise Model (TNM<sup>®</sup>)

- ◆ Predict Design Year Traffic Noise Levels
- ◆ Identify Impacted Noise Receptors
- ◆ Design Optimum Noise Abatement Measures

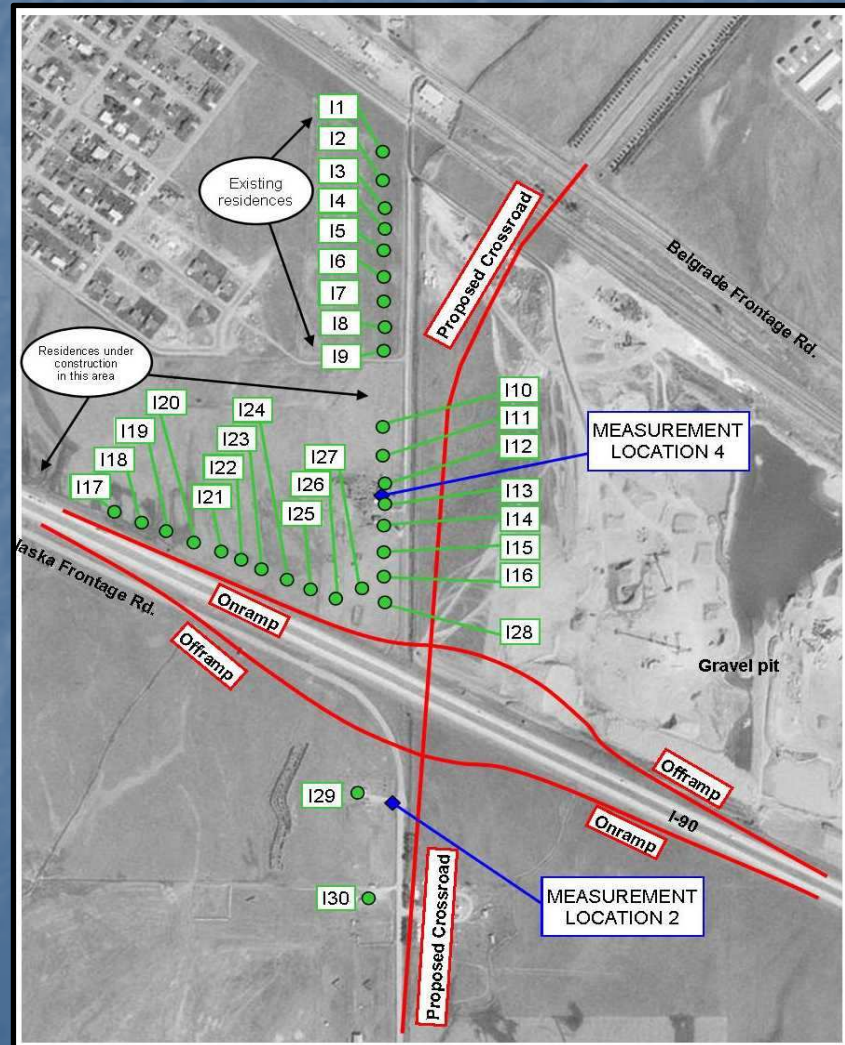
# Equivalent Sound Level Over Time ( $L_{eq}$ )





# Identify Receivers and Predicted Impacts

- ◆ Residences
- ◆ Parks
- ◆ Hotels
- ◆ Schools
- ◆ Hospitals
- ◆ Libraries
- ◆ Cemeteries
- ◆ Commercial areas



# Federal Regulations

# **Title 23 CFR Chapter 772**

## **PROCEDURES FOR ABATEMENT OF HIGHWAY TRAFFIC NOISE AND CONSTRUCTION NOISE**

- ◆ Provide general procedures for noise studies and noise abatement
- ◆ Detail noise abatement criteria
- ◆ Establish requirements for information to be given to local officials related to noise sensitive areas



# Noise Abatement Criteria (NAC)

Activity Category	Leq(h)	Description of activity category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D		Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.



## Common Outdoor and Indoor Noises

Outdoor Noises	Sound Pressures (uPa)	Sound Pressure Levels (dB)	Indoor Noises
Jet Flyover at 300 m	6,324,555	110	Rock Band at 5 m
Gas Lawn Mower at 1 m	2,000,000	100	Inside Subway Train (New York)
Diesel Truck at 15	632,456	90	Food Blender at 1 m
Noisy Urban Daytime	200,000	80	Garbage Disposal at 1 m
Gas Lawn Mower at 30 m	63,246	70	Shouting at 1 m
Commercial Area	20,000	60	Vacuum Cleaner at 3 m
Quiet Urban Daytime	6,325	50	Normal Speech at 1 m
Quiet Urban Nighttime	2,000	40	Large Business Office
Quiet Suburban Nighttime	632	30	Dishwasher Next Room
Quiet Rural Nighttime	200	20	Small Theatre, Large Conference Room (Background)
	63	10	Library
	20	0	Bedroom at Night
			Concert Hall (Background)
			Broadcast and Recording Studio
			Threshold of Hearing

**Commercial Threshold  
72 dBA**

**Deafening**

**Very Loud**

**Loud**

**Moderate**

**Faint**

**Very Faint**

**Residential Threshold  
67 dBA**

# NCDOT Traffic Noise Abatement Policy

Adopted September 2, 2004

# Purpose

Provide guidelines for:

- ◆ evaluating traffic noise impacts to communities and facilities
- ◆ determining the need for noise abatement and the feasibility and reasonableness of abatement measures
- ◆ equitable administration of policy



# Application

## "Type I" projects ONLY

Construction of highway on new location or physical alteration of existing highway which significantly changes either the alignment or capacity

## "Type II" projects

Project for noise abatement on existing highway



# **Information for the Public and Local Officials**

Public information - meet with public and private parties as needed

Public documents - identify noise-sensitive areas and proposals for noise mitigation measures

Corridor/Design Public Hearing - present and discuss proposed noise abatement measures

# Date of Public Knowledge

Approval date of the final environmental document, e.g., Categorical Exclusion (CE), State or Federal Finding of No Significant Impact (FONSI) or State or Federal Record of Decision (ROD).

# Date of Public Knowledge

After this date, the federal and state governments are no longer responsible for providing noise abatement measures for new development within the noise impact area of the proposed highway project

It is the responsibility of local governments and private landowners to ensure that noise-compatible designs are used for development permitted after this date



# Noise Impact Determination and Abatement

Future traffic noise levels determined by traffic volumes projected for the roadway “design year”

Traffic noise abatement must be considered when traffic noise impacts are created by either

- ◆ Approaching or exceeding Federal NAC
- ◆ Substantially exceeding existing noise levels



# Substantial Noise Level Increase

Existing Leq(h)	Increase
50 or less dBA	15 or more dBA
51 dBA	14 or more dBA
52 dBA	13 or more dBA
53 dBA	12 or more dBA
54 dBA	11 or more dBA
55 or more dBA	10 or more dBA

# Noise Impact Determination and Abatement

NCDOT defines “approach” to be within 1 dBA of the  $Leq(h)$  value for the activity categories

Noise impact thresholds for each NAC category are actually 1 dBA less than those listed in the NAC table

# Noise Mitigation Measures

## Feasible

- ♦ primarily design and engineering considerations

## Reasonable

- ♦ must show that good judgment and common sense were used process



# Feasible ?

1. Topography will allow construction
2. Minimum 5 dBA reduction for front row receptors
3. Access, drainage, safety and maintenance requirements are not compromised
4. Other noise sources are not significant
5. Non-controlled or partial access control of highway



# Reasonable ?

1. **Abatement cost < allowable cost per benefited receptor**
  - ♦ \$35,000 + \$500 per dBA average increase in predicted exterior noise levels
2. **Barrier height and scale**
  - ♦ does barrier cause severe adverse visual impact ?
3. **Difference between existing and future noise**
  - ♦ < 3 dBA undetectable by most people

# Reasonable ?

## 4. **Opinions of impacted residents**

- ◆ >50% of first row receptors want the barrier ?

## 5. **Isolated receptors**

- ◆ cost versus benefits provided usually excessive

## 6. **Commercial areas**

- ◆ businesses usually prefer visibility and accessibility

# Reasonable ?

## 7. **Residential multi-unit complexes**

- ♦ category E unless exterior areas of frequent use

## 8. **Special use areas**

- ♦ playgrounds; special exterior areas of churches, hospitals, retirement homes; parks and camps



# Noise Wall Construction, Materials and Aesthetics

Consideration should be given to providing earth berms for noise abatement purposes on projects that have earth waste and where sufficient right-of-way exists to construct the berms



# Noise Wall Construction, Materials and Aesthetics

Materials used in construction of noise barriers and other abatement measures should be an engineering decision based on economics, effectiveness and visual impacts

Visual impact considerations will ensure that the proposed noise wall meets a basic aesthetic level as well as a basic durability level so that excessive deterioration or corrosion will not occur

# Noise Wall Construction, Materials and Aesthetics

The steel pile and concrete panel wall is NCDOT's standard noise wall however, NCDOT will consider Context Sensitive Solutions (CSS) as long as other criteria are met



# Noise Wall Construction, Materials and Aesthetics

Traditional highway construction resources pay for required noise abatement measures

If a local government requests materials that are more costly than those proposed by NCDOT, it must assume 100% of the additional cost



# **Noise Wall Construction, Materials and Aesthetics**

If a local government requests a noise abatement measure deemed not reasonable by NCDOT, the measure may be installed if the local government assumes 100% of all costs and must ensure that NCDOT's material, design and construction specifications

# Review of Policy

# **Review of Policy**

This policy shall be reviewed in a manner determined by the Board of Transportation at least every five years.



# **Review of Policy**

- ◆ 23 CFR 772 undergoing revisions
- ◆ Comments due 11/16/2009
- ◆ Expected to be final in mid-2010
- ◆ Revised NCDOT Policy due within 6 months
- ◆ Policy Review Committee currently meeting

# Review of Policy

- ◆ Significant Considerations
- ◆ Change Allowable Cost per Benefited Receptor from \$ to ft<sup>2</sup>
- ◆ Reduce Policy to true policy and remove informational text in conjunction with development of a Technical Guidance document

# Solicited Input

- ◆ All NCDOT Divisions
- ◆ MPO's / RPO's
- ◆ Private Consulting Firms
- ◆ Public
- ◆ Municipalities



# Additional Activities

- ◆ Tire/Pavement Noise Research
- ◆ Improving Public Outreach/Education
- ◆ Promote Noise-Compatible Land Use

**Comments / Questions ?**

# Additional Information

FHWA Highway Noise Web Page:

[www.fhwa.dot.gov/environment/noise/index.htm](http://www.fhwa.dot.gov/environment/noise/index.htm)

NCDOT Traffic Noise Web Page:

[www.ncdot.org/doh/preconstruct/pe/ohe/noiseair](http://www.ncdot.org/doh/preconstruct/pe/ohe/noiseair)

AASHTO Noise Web Page:

[environment.transportation.org/environmental\\_iss  
ues/noise](http://environment.transportation.org/environmental_issues/noise)



# Future Contacts

Gregory A. Smith, LG, PE  
Traffic Noise & Air Quality Supervisor  
Human Environment Unit  
1598 Mail Service Center  
Raleigh, NC 27699-1598

Phone: (919) 431-2010  
E-mail: [gasmith@ncdot.gov](mailto:gasmith@ncdot.gov)



**DANGER AHEAD  
FASTEN SAFETY BELTS  
AND REMOVE DENTURES**

---

**GEVAAR VOOR  
MAAK GORDELS VAS  
EN VERWYDER KUNSTANDE**